CAMBRIAN INTRUSION-RELATED COPPER MINERALISATION AT THE THOMAS CREEK PROSPECT, SOUTHWESTERN TASMANIA

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By

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ABSTRACT

The Thomas Creek Prospect lies at the southern end of the Sorell Peninsula, western Tasmania and consists of intrusions believed to be coeval with copper mineralisation within a dioritic intrusive complex. The prospect is hosted by the Noddy Creek Volcanics, which are geochemically correlated to the calc-alkaline Mt Read Volcanics.

Widespread (600 by 400 m) but low grade copper mineralisation is hosted by diorites and feldspar-augite porphyritic andesite intrusions, which have been intruded by chalcopyrite-bearing porphyritic micromonzodiorites. Early disseminated magnetite, pyrite and chalcopyrite formed prior to and synchronous with pervasive feldspar-silicate alteration. Various chalcopyrite-bearing vein generations (actinolite, tourmaline, K-feldspar - smectite, epidote and carbonate) have overprinted the early-formed magnetite and feldspar-silicate alteration assemblages.

The "immobile" elements (Ti and P) were mostly mobilised during the formation of pervasive K-feldspar hydrothermal alteration at Thomas Creek. A subset of the geochemical data set exhibits coherent behaviour, indicating that the diorites and porphyritic micromonzodiorites form a co-magmatic fractionation series. Coherent behaviour of Ba, Rb, Sr and K_2O has been recognised for the igneous suite. Both primary and secondary K-feldspar appear to be intrusion-related. Fe, S, P, Zn and Cu appear to have been lost during fractionation due to devolatilisation of the micromonzodiorite magmas.

Sulphur isotope values of sulphides at Thomas Creek range from -4.9 to 11.5‰. Sulphides in the early formed magnetite and feldspar-silicate alteration assemblages have similar $\delta^{34}S$ ranges (5.3 to 9.3‰). The isotopic range in the porphyritic micromonzodiorites (8.2 to 11.5‰) is believed to have formed in response to fractionation and devolatilisation of ^{32}S-rich hydrothermal fluids, resulting in isotopically lighter signatures (-4.9 to 7.7‰) in veins related to the intrusions. Sulphur

isotope geothermometry, utilising co-existing pyrite-chalcopyrite pairs, indicates mineralisation temperatures in veins ranged from 254 to 611^{o}C.

Four stages of mineralisation have been recognised at Thomas Creek: 1:- early magnetite and feldspar-silicate alteration; 2:- emplacement of Cu-bearing micromonzodiorite intrusions and precipitation of coeval actinolite and tourmaline veins; 3:- K-feldspar - smectite vein formation; and 4:- epidote and carbonate veining. Phases 1 and 2 represent periods of magma emplacement with some mixing of magmatic-hydrothermal water with seawater-derived fluid. Phase 3 veins appear to be of magmatic character, with minimal seawater influence. Phase 4 probably represents final incursion of seawater-derived fluids as the magmatic system waned.

Thomas Creek can be correlated to Mt Lyell copper-gold mineralisation, based on similarity of sulphur isotope distribution and ore mineralogy. Mineralisation at the Thomas Creek Prospect is believed to represent the root zone of a Mt Lyell-type hydrothermal system. There are also some similarities with the alkaline porphyry Cu-Au deposits of British Columbia, with Thomas Creek possibly being the submarine analogue of a porphyry system formed in a back arc environment.

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